

## DETAILED ACTION

### ***Claim Rejections - 35 USC § 102***

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. Claims 1-3 are rejected under 35 U.S.C. 102(b) as being anticipated by Tsukada et al. (US 2002/0012015).

#### **Tsukada et al. discloses the following claimed limitations:**

- **Claim 1:** an expendable container [liquid container 1] capable of measuring a residual quantity of stored expendable [paragraph 0074 and Abstract], the expendable container comprising:
  - an expendable tank [container] configured to store the expendable [ink] and has a piezoelectric sensor element [actuator 106 is used to detect the consumption condition of ink (i.e. as a sensor); paragraphs 0074 and 0087] attached thereto [as seen in figs. 1A-2; paragraph 0086];
  - a driving circuit configured to energize and de-energize the piezoelectric sensor element [with electrodes; paragraphs 0082 and 0141; it is inherent that the drive signal is outputted by a driving circuit];
  - a detection signal generation circuit configured to generate a detection signal including cycle information representing a cycle of an output voltage

wave of the piezoelectric element after the driving circuit energizes and de-energizes the piezoelectric sensor element [from the residual vibration; paragraphs 0099, 0100 and 0142]; and

- a control module [861; inherent that it controls all the functions of the circuit] configured to control at least one of an impedance of a de-energizing circuit through which the piezoelectric sensor element de-energizes and a de-energizing time [paragraphs 0089 and 0090; the transmission circuit controls the vibration (i.e. energizing) and therefore the amplitude (and thus the impedance) of a residual vibration (that occurs when it's de-energized and depends on the magnitude of the vibration part of the actuator)] so as to be a certain level that reduces a noise element present in detecting the cycle information of the detection signal [the higher the amplitude of the vibration, the easier the detection (i.e. less noise)], wherein
  - the cycle information is available for determining whether the residual quantity of the expendable is greater than a preset level [paragraphs 0087 and 0087; it detects whether the liquid is above or below a certain level];
  - the control module is configured to vary a property affecting an output signal of the piezoelectric sensor element [paragraphs 0089 and 0090; see explanation above].
- **Claim 2:** wherein the control module is configured to vary a de-energizing time constant of the piezoelectric sensor element [the counter electromotive force

generated by the residual vibration (when de-energized) varies with the amplitude of the vibration part of the actuator; furthermore, the changing cycle of magnitude of the counter electromotive force varies with the frequency of the residual vibration remaining in the vibration part of the actuator].

- **Claim 3:** wherein the control module is configured to vary a de-energizing time of the piezoelectric sensor element [the counter electromotive force generated by the residual vibration (when de-energized) varies with the amplitude of the vibration part of the actuator; furthermore, the changing cycle of magnitude of the counter electromotive force varies with the frequency of the residual vibration remaining in the vibration part of the actuator].

### ***Claim Rejections - 35 USC § 103***

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claim 4 is are rejected under 35 U.S.C. 103(a) as being unpatentable over Tsukada et al. (US 2002/0012015) in view of Yamamoto et al. (US Patent 4,714,935).

**Tsukada et al. discloses the claimed invention as discussed above regarding claim 1 but fails to expressly disclose the following claimed limitations:**

- **Claim 4:** wherein the detection signal generation circuit comprises:

- a voltage generation circuit configured to generate a predetermined potential difference between a first terminal with a higher potential and a second terminal with a lower potential;
- the piezoelectric sensor element having one end connected to the second terminal;
- an energization control switch connected between the first terminal and the other end of the piezoelectric sensor element, and configured to control on and off charging from the first terminal to the piezoelectric element according to a control output from the control module;
- a de-energization control switch connected between the other end of the piezoelectric sensor element and the second terminal and configured to control on and off de-energization from the piezoelectric sensor element to the second terminal according to the control output from the control module; and
- a resistive circuit connected between the other end of the piezoelectric sensor element and the second terminal, and having a variable resistance, wherein
- the control module is configured to control the on-off of the energization control switch, the on-off of the de-energizing control switch, and the resistance of the resistive circuit.

**Yamamoto et al. discloses the following claimed limitations:**

- **Claim 4:** wherein the detection signal generation circuit comprises:

- a voltage generation circuit configured to generate a predetermined potential difference between a first terminal with a higher potential and a second terminal with a lower potential [positive and negative electrodes; col. 7, lines 21-35; as seen in fig. 7];
- the piezoelectric element having one end connected to the second terminal [connected to ground];
- an energization control switch [37 in fig. 7] connected between the first terminal and the other end of the piezoelectric sensor element, and configured to control on and off energizing from the first terminal to the piezoelectric element according to a control output from the control module;
- a de-energization control switch [35 in fig. 7] connected between the other end of the piezoelectric element and the second terminal and configured to control on and off de-energization from the piezoelectric element to the second terminal according to the control output from the control module [col. 7, line 21 through col. 8, line 6]; and
- a resistive circuit connected between the other end of the piezoelectric sensor element and the second terminal, and having a variable resistance [40 in fig. 7], wherein
- the control module [fig. 9] is configured to control the on-off of the energization control switch, the on-off of the de-energizing control switch, and the resistance of the resistive circuit [inherent; Abstract].

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to modify the control unit in the Tsukada invention to include a circuit that comprises a voltage source that causes a potential difference between first and second terminals, the piezoelectric having one end connected to the second terminal, an energize/de-energize control switch and a resistive circuit connected between the other end of the piezoelectric element and the second terminal having a variable resistance as taught by Yamamoto et al. for the purpose of controlling the charging and discharging of the piezoelectric element and thus obtain improved results.

### ***Response to Arguments***

5. Applicant's arguments with respect to claims 1-4 have been considered but are moot in view of the new ground(s) of rejection. Please note that Tsukada et al. discloses a piezoelectric sensor element and control module that is configured to vary a plurality of properties of the piezoelectric sensor element.

### ***Conclusion***

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

***Communication with the USPTO***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to JANNELLE M. LEBRON whose telephone number is (571)272-2729. The examiner can normally be reached on Monday thru Friday 8:30am-5:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew Luu can be reached on (571) 272-7663. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Art Unit: 2861

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